University of Michigan

ENGINEERING NEWS.

A WEEKLY JOURNAL OF ENGINEERING, ARCHITECTURE, MINING, MANUFACTURES, AND GENERAL SCIENCE.

Vol. III.—No. 19. CHICAGO, SATURDAY, MAY 6, 1876. Subscription $2.12 per year Single copies, 6 cents

NOTES.

Mr. Charles Pfeiffer is the new City Engineer of St. Louis.

Three triangulation parties on the Lake Survey will leave Detroit for the spring campaign, May 16.

The damage done to the bridges on the Southern Minnesota Railroad by the recent floods is estimated at $30,000.

Recent foreign mails bring intelligence of the death of Signor Severino Grattoni, the Italian engineer, to whose energy is due the successful construction of the Mont Cenis Tunnel.

A company has been organized to build the Van Buren division of the Toledo & South Haven Railroad. The road is to run from Lawton to Bangor, Michigan, twenty-two miles and is to be three feet gauge.

The large plate glass manufactured by the Star Glass Company, New Albany, Ind., and the largest one ever made in America, and of superb size and finish, designed expressly for the Indiana headquarters at the Centennial, was unfortunately broken last week in the process of boxing for shipment.

One hundred and forty feet of the Eagle Rapids dam, at Chippewa Falls, Wis., went out on Tuesday morning of last week. Fifty million feet of logs from the jam above came crashing down, but were caught in A. E. Pound's & Co's. boom. Damage slight. The Chippewa is high, but falling.

In pile-driving, where the clay, sand, or other material beneath the water is so tightly packed as to impede the entrance of the pile, a small gas pipe may be let down beside the pile and a powerful stream of water forced through the pipe. This stream stirs up and loosens the silt and thus materially assists the work.

Our Boston correspondent writes, "Business seems to be duller among engineers now, than any time in the winter, as far as I can learn. There is not a railroad that has been proposed this spring which has had enough money to pay for a survey, and I know of one instance where the engineer did three months work and has not, as yet, received a dollar for it. It is still doubtful whether H. Blanchard and others, of Boston, have the contract for the road from St. Stephens to St. Johns. The Park Commissioners have made their report."

A beam compass for the use of draughtsmen and students has been introduced that for cheapness and ease of construction is worthy of imitation. It consists of a flat bar of wood set on edge, and provided at one end with a metal pin, that serves as the centre of the circle. On the bar slides a square piece of cork fitted with four or more holes of different diameters, for holding pens or pencils, or a knife for cutting out cardboard. The cork by its elasticity will easily hold the tools in place, and retain its position on the bar, while at the same time it can be readily adjusted on the beam.

Several prominent capitalists of Colchester, Conn., visited New York a few days ago with a view of getting aid to secure a branch line from Turner's Station on the Air Line road to Colchester Center, which is now some two miles from the depot. The meeting led to encouragement that the line would be built, and already surveyors are at work and report that the line can be built without great expense. When this is finished it is quite likely that a further extension will be made to the New London Northern road at Yantic, a part of this other extension having been surveyed and graded some years ago.

Ten thousand people witnessed the successful launching of the new steamer, Robert E. Lee, at Howard's shipyard, Jeffersonville, Ind., last week. Her entire length is 320 feet. She will carry 8,000 bales of cotton. Her cabin is to be a dazzling palace, which will defy the competition of all predecessors or rivals for public favor on the great Mississippi. She has nine monstrous steel boilers, and her engines will be marvels of mechanical skill, and will rank the largest high-pressure engines ever built in the West. She is built for the Mississippi River, by J. W. Cannon, of New Orleans, and when completed will cost over $250,000.

An ingenious device for the ventilation of ship's cabins and holds consists of two iron tanks, placed on either side of the upper deck and connected together by a pipe. An outlet pipe to each is provided with a valve opening outwards, and inlet pipes from the hold have valves opening inwards, both of these sets of pipes communicating with the upper part of the tanks. The tanks are about one-fourth full of water when the ship is on an even keel, and the rolling of the ship, causing the water to flow from one tank to the other alternately, pumps up the air and discharges it from the outlet pipes. The blast is quite strong.

Capt. Eads reports that, April 26, the channel of the Mississippi through and beyond the jetties into the Gulf was carefully sounded. The least depth through the entire channel was sixteen feet and four inches at average tide, an increase of ten inches since the 15th. The report of the shoaling in advance of the jetties is false; there is a very decided deepening there. He says that he shall have nothing to do with the request for the use of a Government dredge. "I could secure a deep channel easier with it, but my motive would be misconstrued. I can await the unaided but certain action of the jettied current to secure our payments from the Government, as patiently as the public can await the deep channel at the mouth of the Mississippi.

As our readers all know, a large amount of grading and bridging was done several years ago on the railroad which was being built under the name of the Iowa Northern R. R., to connect Keokuk and Cedar Rapids by way of Washington and Iowa City. The company however failed to prosecute the work for want of funds, and for some time the undertaking has been regarded as defunct. There is a prospect however that this work may yet be completed. The road from St. Louis to Keokuk on the west side of the Mississippi is now almost finished, and that company are now making propositions to extend their road into Iowa on the old track of the Iowa Northern. We have every reason to believe that at no distant day this gap will be filled.—*Cedar Rapids Republican*

Engineers' Club of St. Louis.

(Reported for Engineering News.)

The 170th regular meeting of the club was held at the rooms on Wednesday, April 5th and was called to order by the President, Col. Flad. Minutes of the last regular and last called meeting were read by the Secretary, and on motion approved.

The committee on the "metric system" reported that their memorial had been prepared and forwarded to Congress and that other societies in St. Louis had also forwarded similar petitions.

The Secretary reported progress in the matter of mss copies of Mr. Pfeiffer's paper on "Arch Bridges" and two gentlemen were proposed as members of the club. Mr. E. D. Meier exhibited to the club a form of "watch clock" which kept a record of the time and place of the night watchman.

Mr. Jas. E. Mills then read a paper on "Certain Improvements in Blast Heating Apparatus" being an account of some hot blast stoves built by him for the Midland furnace.

After a vote of thanks to Mr. Mills for his interesting and valuable paper the club instructed the Secretary to prepare copies of the same, and a discussion took place on pyrometers, and the general subject of "hot blast," which was taken part in by Messrs. Potter, Meier, Flad, Whitman, Dr. Klupfel, and Smith. Various devices were described for measuring the temperatures of the blast, and the efficiency of the stoves.

Some remarks were made by Thos. J. Whitman concerning the use of air channels upon water pipes where quick acting valves were used and the desirability of their use for the pipes of the "water cranes" used in the city for supplying locomotives. Mr. Pfeiffer exhibited a profile of the S. W. Pass showing soundings taken at different dates and exhibiting very plainly the improvement in the channel and the scour caused by the jetties constructed by Capt. Eads. On motion adjourned.

Telescopic Caisson or Diving Bell.

A new and improved pattern of diving bell has been introduced for laying concrete foundations in deep water The plant consists of a large flat bottomed boat or pontoon, resembling those used in dredging, and properly supplied with engines, air-compressors, and other steam dredging machinery. At the bow of the boat is erected a lofty iron framework slightly overhanging the water and capable of sustaining the weight of the immense diving bell and its connections. At the top of this are two wrought-iron chambers, one over the other, and connected by an air tight door or manhole. The smaller chamber is about three metres square. From the bottom of the lower chamber hangs a wrought-iron tube, five metres long and about two metres in diameter. Into this are fitted three more tubes, each of the same length, and each a few decimetres less in diameter than the other. From the bottom of the central tube is suspended a square diving bell, sufficiently large to hold a number of men with their tools and moulds for making concrete blocks. All the connections between the tubes are air-tight, and, when the upper chambers are closed, the bell and its telescopic tubes make a continuous air-tight chamber.

When at work, the telescopic tubes are extended till the bell touches the bottom, or till it is expanded to its full length of seventeen metres. Suitable guides are provided at the sides of the tube to keep it steady in the water, and, by a peculiar arrangement of the packing between the tubes, allowance is made for the movement caused by waves or currents. By means of air compressors the water is kept out of the bell. The tubes serve for a hoistway and well for the passage of man and materials, and extra pipes are provided, if desirable, outside the tubes, for sending cement and sand down to the bell from a boat outside. These pipes are also provided with air-locks to prevent the escape of air and entrance of water. Powerful hoisting apparatus is supplied for lifting the entire apparatus to the surface of the water, or to adjust it to any depth. When not in use, the telescope is closed up till the bottom of the bell hangs level with the bottom of the boat. If desired, the entire apparatus may be raised clear of the water, and may be supported by the frame work while the boat is moved from place to place. This ingenious and interesting plant has been in operation for several months, and is reported to give entire satisfaction to the engineers in charge.

STREET PAVEMENTS.

An Exhaustive Review of the Subject by Mr. Robert Moore before the University Club.

Faults and Excellencies of the Various Systems with Estimates of the Respective Cost of Each.

(From the St. Louis Republican.)

Prof Gillespie in his excellent Treatise on Road Making observes that: "The roads of a country are accurate and certain tests of the degree of its civilization. The construction is one of the first indications of the emergence of a people from the savage state, and their improvement keeps pace with the advance of the nation in numbers, wealth, industry and science—of all which it is at once an element and an evidence."

If with this test—which is certainly as applicable to the town as to the country—we set out to determine the comparative civilization of our cities, and particularly our own city, we shall, I think, be obliged to confess that American cities rank in the main far below the cities of Europe, and that of all American cities the least civilized is probably the city of St. Louis. For of all our claims to pre-eminence the pre-eminent badness of our streets is one of the most easy to establish.

To be sure this test, like all other sweeping tests, must be used with caution. It is just possible that we may in some other qualities make up for the barbarism of our streets. And we are indeed not without something to say for ourselves by way of excuse.

For example, we can plead in common with all American cities that the Democratic form of our government, whilst it answers well enough for the state and nation, is not a good form of government for a city, at least without very decided modifications.

Our taxes are not levied, as they ought to be, by those who pay them, but are often voted by those who pay nothing, and whose only interest in them is, after they are raised, to divert as much as possible into their own pockets. Our revenues are squandered in jobs. They are treated as a sort of poor-fund for the relief of political beggars. Then, too, our American plan of appointing public officers for party services, and rotating them out of office as soon as they learn their business, secure us, as a rule, only unfit men.

But, in addition to such excuses as we have in common with other cities, we have one that is specially our own, viz.: That the material for making good pavements does not lie so near as to other cities, whilst the bad material which we do use lies right under our feet.

These excuses, however, even if they were sufficient, as they are not, are good only for the past, and will not serve us for the future. The defects in our modes of municipal government are not without remedy. The tax payers have only with united voice to insist that municipal business shall be conducted upon business principles to insure all the reform we need. Reform may be difficult, but to give up in advance without effort is simply weakness. And so with our other excuse—the want of good materials—it will avail us no longer.

An abundance of good materials lies within easy reach and if we do not hereafter use them, the only thing that can be said for us will be that we have not yet reached that degree of civilization in which intelligence and experience are allowed to govern.

It becomes us then as citizens to address ourselves to this problem of getting good street pavements in St. Louis with a fixed determination that it must and shall be solved.

In discussing this subject, I will first mention the characteristics of a good pavement; after that pass in review the most prominent classes of pavements, and then conclude with a few practical considerations and recommendations applicable to our own city.

CHARACTERISTICS OF A GOOD PAVEMENT.

If we consult the dictionary we shall find that the word pavement is from a Latin word meaning to ram or beat down, and that it means primarily a road surface made by ramming, this being the way in which block pavements such as the Romans used are usually consolidated. Usage, however, has extended this meaning until the word now includes every form of artificial road surface. Any material added to the native earth to improve the surface of a road or a street is a pavement. The use of a street pavement is to facilitate the movement of wheeled vehicles drawn by horses, and that is the best pavement which accomplishes the object best. To diminish the resistance of the wheels a good pavement must be smooth and hard, and for this purpose the smoother and harder the better. The wheels ought not to sink into the pavement at all. For any sinking of the wheels puts it into a valley, up the sides of which it must be continually pulled, to the great loss of motive power. This requirement excludes the property of elasticity which is often spoken of as a commendation of various kinds of pavements.

The pavement on which the traction would be least would be a perfectly smooth floor of iron. But as our common vehicles are drawn by horses this requirement must be limited by another, viz: That the pavement must not be so smooth as not to afford a good and safe foothold for horses. In the case of street cars these two opposing conditions are harmonized by having an iron track for the wheels and a pavement of some rougher material for the horses. But this sacrifices the homogeneity of the road and also unfits the vehicles for general use.

For ordinary wagons and carriages we must have a pavement which is not perfectly smooth but rough enough to give the horses a good foot hold. For the same reason a very moderate degree of elasticity may be allowed, though it should never be forgotten that it is admitted only as a compromise and that the wagon pulls harder on account of it. In addition to these prime requisites of evenness and hardness a good pavement should be durable, noiseless, easy cleaned and capable of being taken up when need be without serious difficulty.

If to these we add cheapness in first cost and ease of repair we have all the traits of a perfect pavement.

And now comes the question, What pavement best fulfills these conditions? To answer it I will review as briefly as I can the most important classes of pavements describing each one and comparing it with our ideal standard.

MACADAM PAVEMENTS.

First, and to us perhaps the most interesting of all, comes the macadam pavement. This is composed of small broken stones laid upon road bed, and packed either by rolling, or, as with us, by the ordinary travel until it becomes a firm and compact mass.

The name of this kind of road comes from that of John Loudon Macadam, a Scotchman, who, prior to our Revolution, came to this country. During the war he lived in New York, and was an agent for the British Government for the sale of prizes, in which position, like some government agents since his time, he is said to have made a considerable fortune. After the war he was compelled by the odium in which all Tories were held to leave the country and return to Scotland.

Here he became a justice of the peace and road trustee. It was whilst acting in the latter capacity that he became impressed with the value of broken stone as a material for making roads. So great was his sense of its value that from 1811 until his death in 1836, he gave his whole time to the making of broken stone roads and became the apostle of this kind of road. So successful were his efforts in this behalf that before his death nearly all the roads of the kingdom were improved in this way. Though the name of Macadam has become identified with this kind of road it is a mistake to suppose that it originated with him. Broken stone had already been employed for the same purpose by John Rennie, the Scotch engineer. and it had been used elsewhere in other countries. But Macadam first fully saw the value of this system, and by his subsequent devotion to it he, perhaps, merits the honor of giving it his name.

He wrote a book in which this method of road building is set forth and in which he promulgated diverse doctrines on the subject which subsequent experience has shown to be untrue. For example, he has much to say of the value of an elastic road bed, preferring a marsh as a foundation for his broken stone to a ledge of solid rock. But Telford and Macneil, by careful experiments afterwards, proved that the traction of any vehicle was less the more solid the road bed, and Telford, who, perhaps, brought to bear upon this subject more skill than all other engineers together, made it his study how to give to the road bed the greatest possible firmness.

As a result he hit upon a plan which has ever since gone by the name of

THE TELFORD ROAD.

The characteristic feature of this plan is that a pavement of rough stone from 6 to 8 inches deep, set by hand is first laid upon the road bed and upon this is then laid the coating of broken stone which is common to this plan and to that of Macadam. Telford was also very careful about the drainage of the road bed and before a stone was laid provided a thorough system of ditches to carry off all the water. For if water is allowed to saturate the earth upon which the pavement rests it will be impossible to give solidity by any coating of the top.

This was the system followed by Telford in that splendid highway, the Holyhead road, built by the government through North Wales and across the island of Anglesea.

That this plan was a great improvement upon that of Macadam have been proven by the most ample experience. But Macadam himself rejected it and adhered with great zeal to his original plan. Quite a warm controversy sprung up between the partisans of the two systems which forms a very interesting chapter in the history of road building.

There is no longer, however, any controversy in the matter. All road builders who has given the subject any study admit that the Telford system is the best. The large stones of the sub-pavement distribute the load over a large surface and do not sink into the earth as the smaller stones will do.

There is no mixing up of the earth and the stones, as is often the case with the macadam road. Again, the stones of the lower pavement being themselves wedged firmly together prevent the moving and grinding of the smaller stones upon each other which, where the pavement is wanting, will sometimes round off the stones at the very bottom of the road. In the Telford system the wear is confined to the top surface and so reduced to a minimum. The top also lets through any water that may penetrate the top coating and keeps it always dry. A road built on this plan will therefore need less repairs and last longer than one built without the pavement. Sir John McNeill, who made very careful observations on this point, put the annual saving in repairs from the paved bottom at 33 per cent. (See Parnell on Roads p 163)

And finally the Telford road is the cheaper of the two in first cost. In England it was proven before a parliamentary commission that a macadam ro ad 10 inches deep cost more than a Telford road 12 inches deep, whilst if both were of the same depth the cost of the macadan was 21 per cent the most. (Parnell, p. 141–2) In Central Park, New York, where trial samples of both were built and the cost carefully kept, the differences in favor of the Telford road was from 3 to 16 per cent.

The reason for the saving in cost is that to lay and wedge the sub-pavement is less expensive then to break up and spread the same stones in the form of macadam.

If then we use broken stone at all we should use it in the form of a Telford rather than a macadam road. And when property made of good materials a road of this kind is a very good one for a moderate traffic. It is firm, hard and smooth, yet not too smooth, and is not easily broken up by rain or frost. All who have seen the broken stone pavements of London or Paris or the new Telford roads in and around New York, will testify to the excellence of this kind of road under proper conditions.

But these conditions are imperative; the materials must be good, and the traffic must not be excessive. To insure any degree of durability the stones used for the top coating should be hard and tough. For the sub-pavement almost any stone that will not disintregate by exposure may be used even though it be quite soft. But if a soft stone like our St. Louis limestone be used for the top coating it is rapidly ground up with all the attendant horrors of mud and dust that we know so well. In England and in Europe generally the stone in most common use is granite. Basalt is also used, and in Paris they use porphyry though at double the cost of limestone. (See VanNostrand's Eclectic, vol. VI, p 306.) In Central Park, New York the stone used is granite boulders, and on the new boulevards they use trap. In general the harder and tougher the stone used for top covering the better.

In this connection, I may be reminded of the experiment made with broken porphyry, here in St. Louis, a few years ago, the result of which was that after laying it on over five miles of streets at an expense of nearly $200,000, it was pronounced a bad failure, and the contractor was bought off at a cost of over $16,000.

But without impugning the good faith of those concerned, if we take into account the fact that the porphyry was never rolled nor bound with sand or gravel, as hard rock must always be, but treated exactly as if it had been soft limestone, and that where properly treated elsewhere it never fails to make a good road, we may say safely that its failure in St. Louis reflects on the competency of those in charge and not at all upon the value of the material.

But the other condition—that the traffic must not be great—must also be insisted upon. The wear upon the small stones is so much more than upon the large ones, because of the greater number of edges presented for abrasion that whenever the travel becomes great, say whenever it exceeds 1,500 teams a day, the cost of renewal of a broken stone road becomes so great that a matter of economy if not of necessity. Before, however, passing on to the discussion of stone block pavements, there is a variety of the Telford road, peculiar I believe to this country, upon which it may be well to say a word. It is

THE TELFORD GRAVEL ROAD.

This is a road with a sub-pavement of large stones set by hand exactly similar to that of the ordinary Telford road, but in place of the broken stone it is covered with about six inches of hard, coarse gravel which is bound together with a coating of loam and sand, and thoroughly rolled. This is the kind of road used so generally in Central Park, New York, and which is to be used in our own Forest Park. Though not strong enough for heavy travel, for light travel is probably unsurpassed.

But the gravel needs to be carefully selected so as to be hard, coarse and clean, and with the stones not too much polished, and it must then be rolled and bound with some foreign substance or it will not make a good road.

COBBLE-STONE PAVEMENTS.

When the travel becomes too great for a pavement of broken stone, the first resort in most American cities has been to water-worn pebbles or "cobble stones," as they are commonly termed. New York, Philadelphia, Pittsburgh and Cincinnati are very largely paved in this way. (In New York there are 89 miles of this paving, and in Cincinnati 91½ miles.) To make a good pavement of this sort the stones should be as nearly as possible of uniform size, and should be in depth about twice their width or about 8 inches in depth and 4 inches in width. They should then be carefully laid in a bed of 12 inches or more of gravel or clean sand, and well settled with heavy rammer. In this way we can get a pavement which is much more durable than broken stone, and much less dusty. But it is very rough and noisy, and the traction on it is much greater than on any other pavement. Gen. Gillmore, in a late article puts the traction at three times as much as on a good stone block or asphalt pavement. It is, moreover, so very difficult to get stones of uniform size and bedded uniformly that pavements of this sort are very apt to settle unequally and get out of order. Their roughness also makes them very difficult to clean, and they have on that account, in New York, been pronounced sources of disease. (Report on Sanitary Condition of New York, pp. 24, 118 and elsewhere) Cheapness in first cost is the only excuse for using them, and that is not sufficient. Fortunately for St. Louis the cobble-stones are not to be had without bringing them from a long distance, so that we are under no temptation in the matter.

[TO BE CONTINUED.]

The United States Signal Service.

(From the Detroit Post.)

ORGANIZATION AND WORKING OF THE SIGNAL BUREAU.

Six years ago by joint resolution of Congress, the Secretary of War was authorized to provide for the taking of meteorological observations at the military posts in the interior of the continent, and for giving notice on the Northern lakes and along the Atlantic coast of the approach of storms.

To General Albert J. Myers, Chief Signal Officer of the Army, was intrusted the task of carrying these instructions into effect, and as a result of his labors the American citizen can to-day point with pride to the important and useful bureau so widely and familiarly known as the Signal Service of the United States Army.

Since the establishment of the service there have been obtained many results directly affecting the interest of nearly all classes, but more particularly those of the farmer and the sailor. Indeed, with such confidence have these latter classes come to look upon the daily weather reports, and so great is the use that they make of them, that the signal service may be said to be an actual necessity for the protection and advancement of commercial and agricultural interests.

Recognizing these facts, and realizing the importance that the public should be made acquainted with anything and everything tending to enlighten it in reference to the particular benefits accruing to mankind from the labors of the signal service, it becomes a pleasure to lay before our readers a few facts and descriptions which may prove of more than ordinary interest to the general reader. Avoiding all technicalities, and taking pains to bring our subject down to a popular level, it is hoped to engage in behalf of the signal service some portion of that interest to which, from the intimate connections of its labors with our welfare and happiness, it is justly entitled.

The science of meteorology has been treated with gross neglect in all popular and liberal systems of education, and in the educational systems of nearly all countries save our own it can be said to have no recognized place.

The causes of this neglect are manifold, but of them it is not our province to speak; let it be sufficient for us to know that since the establishment of the signal service a great and growing interest in the subject is being made manifest among all classes, and that this, the youngest of the sciences, is acquiring a rapid and promising development.

The labors of the signal service are many and varied, but for our purposes they may be classed under four heads. 1. The taking and recording of meteorological observations; 2, the displaying of storm signals; 3, the Atlantic coast telegraph service; and 4, the building and equipping of the military telegraphic lines in the Southwest.

HOW THE OBSERVATIONS ARE TAKEN AND RECORDED.

With the general nature of the first named duties all are more or less familiar, but comparatively few really understand how and why these observations are made. Taking the office in this city as an illustration we will hazard a description as to the manner in which the duties connected with it are performed: Seven observations are taken, namely, at the respective hours of 7, 7.11 and 11.36 A. M., and 2, 4.11, 9 and 10.36 P. M. Three of these, the 7.11, 5.11 and 10.36, are known as telegraph observations, and are transmitted over the wires of the Western Union Telegraph Company to Washington. The remaining four are taken for purposes of record and reference, serving in the latter respect to substantiate the accuracy of the telegraphic observations. The taking of an observation consists of the barometer, thermometer, hygrometer, anemometer, anesmescope and rainguage. From the reading of the barometer we obtain the weight or pressure of the atmosphere. This is expressed in English inches and hundredths of an inch. For purposes of comparisons three correction are made: First, for temperature, all readings being reduced to a temperature of 32 degrees: second for elevation, the reading being reduced to the level of the sea, and third, for instrumental error, which includes capillarity or adhesion, and expansion of the metals of which the instrument is constructed.

THE VARIOUS INSTRUMENTS EMPLOYED AND THEIR USE.

The thermometer gives the temperature of the air, which assists us in our barometrical calculations. The hygrometer is a most important instrument and its readings enter largely into all meteorological calculations. This instrument consists of two mercurial thermometers, which, being placed side by side, would indicate the same temperature. The dry bulb is merely intended to show the temperature of the air. The wet bulb is also a common thermometer, having its bulb covered with a piece of cotton-wicking, the lower end of which descends into a cup of rain water. Water rises by capillary attraction from the cup to the wicking, thus keeping it constantly wet. When the air is dry evaporation proceeds rapidly from the wicking, and on account of the heat lost by this evaporation (evaporation producing cold,) the wet bulb indicates a lower temperature than the dry bulb. But when the air is damp evaporation is slower, and the difference between the readings of the two thermometers becomes smaller, and when the air is saturated evaporation ceases and the two thermometers indicate the same temperature. By means of an observation of each of these tubes six important atmospherical conditions may be determined or approximated by means of tables constructed for the purpose. First, the dew point second, the elastic force of vapor or the amount of barometric pressure due to the vapor present in the air; third, the quantity of vapor in a cubic foot of air; fourth, the additional vapor required to saturate a cubic foot of air; fifth, the relative humidity, and, sixth, the weight of a cubic foot of air at the pressure prevailing when the observation is made. The practical importance of these results cannot be overestimated, and are well understood by the meteorologist. For the purposes of the signal service only the relative humidity is calculated and entered in the observation, and this is always expressed and entered in all reports in terms of per cent. Relative humidity must not be confounded with absolute humidity. By the term relative humidity is meant the proportion that the amount of vapor actually present in the air bears to the amount which the air would contain if it were perfectly saturated. This is a distinction with a very great difference, and those who study the daily weather reports need to bear it in mind. The direction of the wind is given by the common wind vane, so constructed as to turn readily with the least friction on any one of its parts. The anemometer gives the velocity of the wind in miles per hour, and from this the pounds pressure per square foot and the force are deduced. This instrument consists of four hollow hemispheres or cups screwed on the ends of two horizontal rods of iron crossing each other at right angles and supported on a vertical axis, which turns freely. When placed in the wind these cups revolve, and the arms are of such a length that when a mile of wind has passed the anemometer 500 revolutions are registered by the instrument. The number of these revolutions is registered by a system of wide wheels set in motion by an endless screw on the upright axis, and these wheels register up to 990 miles. To effect continuous registration an ingenious device is brought into requisition. This consists of a self-registering apparatus, worked conjunctively by means of clock-work and an electric battery. The machinery employed for this purpose is elaborate and too complicated for description here. In addition to the reading of the instruments here described, the state of the weather and kind, direction and rate of motion of the upper and lower strata of clouds is also reported, and when rain has fallen, it too, is measured. The gauge in which the amount of precipitation is measured consists of a cylindrical copper tube two feet in height and two and a half feet in diameter, closed at the lower end. Fitting into the upper end of this is a funnel the greatest diameter of which is about eight inches. The relative diameters of funnel and tube are such that their receiving areas bear a proportion of 10 to 1 and thus making no allowance for evaporation, the smallest rainfall can be accurately measured. As before stated, three telegraphic observations are taken daily reports of these being sent to Washington, they being made synchronously at the exact hours of 7.35 A. M., and 4.35 and 11 P. M., Washington time.

HOW THE PROBABILITIES ARE CALCULATED.

In order to lessen the expense of telegraphy these reports are condensed and sent in cipher, being deciphered into ordinary language when received at the stations for which they are intended. For instance there is received at Washington a message reading:

Detroit—Moaning—Ahead—Bind. Cell—Earnest—Fife—Ginger—Haines.

To the uninitiated this appears to be a jumble of words, but to the signal observer their meaning is at once made plain. These nine words tell a great deal. They inform those who are making up the "probabilities" at Washington and the numerous observers throughout the country who are preparing the morning reports, that at the city of Detroit at 7.30 A. M., the barometric reading was 29.92 inches, the temperature 32 degrees, and the relative humidity 49 per cent., the direction of the wind east, the state of the weather fair, the velocity of the wind six miles per hour, that the wind was blowing steadily, the kind of upper clouds cumulus, their amount one-fourth their direction from the west, the kind of lower clouds stratus, their amount one-half their direction from the east, and that the amount of rain-fall for the past eight hours was ten-hundredths of an inch. All this information is given in these nine words, and the great saving in the cost of telegraph transmission by the use of such a cipher can readily be seen. From these reports the probabilities are made up, and consequently it is essential that great care should be taken in recording them.

By a carefully arranged system of telegraphic operations copies of the full reports of all stations transmitted to Washington, or portions of them are sent at the same time to many of the signal service stations in the principal cities and towns. At all stations receiving such tabular reports bulletins are immediately made and posted in conspicuous places. These bulletins, wherever published, exhibit the following particulars: Height of barometer, change since last report, state of thermometer, change in past 24 hours, relative humidity, direction of wind, pounds pressure of wind per square foot, force of wind reduced to Beaufort scale, kind and amount of upper and lower clouds, rainfall since last report and state of the weather. These reports are posted in this city at various places, and are accessible during business hours. Those on file at the signal office may be seen at any time during the day or night.

A large weather map hung in the rooms of the Board of Trade exhibits by means of changeable symbols the reports of the morning observations at all stations from which reports are received at this office. To those who have learned the practical use of this map it offers a valuable help in estimating the probable character of the weather at any station or over any district during the following day, and often for a still longer period. It posesses this advantage over the bulletin, that while the former merely tabulates the reports alphabetically, the latter reveals to a single glance of the eye a synoptic view at once, of the meteoric conditions of the different stations, and of the deductions thence to be made as to the conditions of the atmosphere then extendiing over the continent. It has an additional value from the fact that it is often possible to trace upon it the progress of storms or the change of meteoric conditions, (as the movement of an area of high or low barometer) from morning to morning, and thus, by considering the past and applying the laws and generalizations reasonably established to estimate more easily the "probability" of the future.

Immediately on the receipt of the reports from the stations throughout the country, the "probabilities," with which the public is so familiar, are prepared at the central office at Washington. These are issued thence at the hours of 1 A. M., 10 A. M., and 7 P. M., daily, and are furnished to the Associated Press, by which they are telegraphed to all its agencies throughout the country. In the study of these probabilities the reader will make sure that he will have before him the latest synopsis and probabilities issued. To be positive of this let him notice the hours at which they are dated from the office of the chief signal officer at Washington. The midnight reports, dated at 1. A. M. of each day, ought to be found in the morning papers of that day. The morning report, timed 10 A. M. each day, is furnished to the evening papers.

At stations centrally located in districts apportioned for the purpose, printing facilities are furnished by means of which the information contained in these "probabilities" is diffused much more widely than it otherwise would be. The "probabilities" are printed as a "Farmer's Bulletin," and copies of them are forwarded in the early mail to all points in Central and Southern Michigan and Northern Ohio and Indiana accessible by rail, where they will arrive in time to be of avail. These are posted up in the local postoffices and the information they convey to the agricultural and other classes is most important and in the main is thoroughly appreciated and extensively utilized.

(TO BE CONTINUED.)

ENGINEERING NEWS.

SATURDAY, MAY 6th, 1876.

GEO. H. FROST, - Editor and Publisher.

153 Washington Street, Rooms 51 & 52, Chicago, Illinois.

Official organ of the

Civil Engineers' Club of the Northwest.

and of the

Chicago Chapter of the American Institute of Architects.

Subscription, $2.12 per annum ; 1.25 for six months, payable in advance. To English subscribers the price is $3.10 American currency.

Club rates, $15.00 for ten copies.

Advertising rates, $2.00 per inch, single column, for each insertion. An extended table of rates for space will be sent on application.

Remittances may be made by Post Office Orders or Bank Drafts payable to Geo. H. Frost. Do not send cheques on local banks.

Agencies.—Alfred Willson, C. E., Canada Company's Office, Toronto, and Geo. D. Ansley, Assistant City Engineer, City Hall, Montreal, are sole agents for *Engineering News* in the Dominion, to whom Canadian subscriptions may be paid, and who will also receive advertisements and furnish full information as to terms, etc., etc., on application.

All communications should be addressed to

Engineering News,

153 Washington Street, Rooms 51 & 52, Chicago.

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TWO AMERICAN INVENTIONS IN GUNNERY.

During the latter part of the year 1874 and the first half of 1875 there was constructed at the Royal Gun Factories, Woolwich, England, an eighty-one ton gun. Experiments have been in progress with it since that time and, although, it is the largest piece of ordnance yet forged, the success attending the proof trials has encouraged the officers in charge to propose cannon of greater weight and calibre. The gun is some twenty-six and one half feet long, made with an inner tube of Firth's steel, nearly twenty-five feet in length and five inches in thickness, and upon this tube are shrunk five wrought iron coils,—four of them side by side but overlapping in succession from the muzzle to the breech, the fifth carrying the trunnions and further strengthening the breech portion. The first coil at the breech is 10½ inches thick and the exterior one 13½ inches thick, bringing the outside diameter of this portion of the gun up to six feet. This latter or trunnion coil weighed as a forging 50 tons, an enormous mass of metal to handle and weld. The bore, of at first 14 inches, was afterwards enlarged to 15 inches and then to 16 inches as the trial progressed. The finished diameter of 16 inches will carry a projectile of 1650 lbs. and burn 300 lbs. of powder.

The system on which this gun is constructed is known as the Fraser or Woolwich system, and the principle employed is the one adopted by the Ordnance Board for heavy arms. We are led to refer to the "Coil System" so called, because it is an American invention, having been first proposed by Prof. Daniel Treadwell of Cambridge, Mass. This was acknowledged to be the fact by one of the officials of the Woolwich Factory quite recently.

Prof. Treadwell was a man of great inventive talent and devised some machines quite universally introduced, notably those for spinning hemp into cordage. Having early interested himself in the manufacture of cannon of larger calibre than those then in use, he made a few small ones of iron and steel for the United States, but did not receive sufficient encouragement, and the manufacture was discontinued. He described a new method in a memoir before the American Academy in 1835, secured his invention by patent, and published an account of it in 1856. He proposed to shrink hoops of wrought iron upon a tube of cast iron. He states that the hoops are to be "expanded by heat, and, being turned on to their places, suffered to cool, when they shrink and compress, first the body of the gun, and afterwards each successive layer all that it encloses."

This method of construction is thoroughly scientific. It can be readily demonstrated that the tensile stress produced is most intense at the interior and rapidly diminishes towards the exterior, and that the compression by the coils will also be most intense at the interior. The initial compression at the bore must therefore first be overcome before tension can be set up. The substitution of a steel tube for the cast iron one is a simple improvement at the present day. It is a little curious that he, in his memoir, goes into a series of calculations, showing that a gun of 14 inches calibre, made in the manner proposed, will bear 63,960 lbs. to the square inch exposed to the gas.

And while on the subject of ordnance it occurs to us to mention that the fundamental idea, also, on which the German Breech-loaders rely, was an American one, and that too was invented in Cambridge, Mass., viz., the expanding thimble or Gas Check. Readers of *Engineering* will recall the many communications in regard to the right of Krupp, of Essen, Prussia, or of the American, L. W. Broadwell, to have the credit of inventing what is known as the "Broadwell ring," and which is used by Herr Krupp in his celebrated steel guns. In the No. of that journal for June 11, 1875, will be found a brief letter from General J. D. Greene, of Cambridge, Mass., setting forth the priority of his claim to this gas check, and citing from his English patent of May 12, 1854. And in the following No, the editors of the paper say—"Even if Herr Krupp did design a gas check ring in 1859, as he says, we have shown that neither he nor Broadwell were the originators of such a ring. It had been done long before by Church and Goddard, who, in their turn, were anticipated by Genl. Greene, whose letter we published last week."

Thus it seems that the inventions which make the English muzzle-loading and the German breech-loading ordnance successful were not only American, but that both originated in Cambridge, Mass.

Improved Sewerage of Boston.

The Superintendent of Sewers doubts the expediency of now going forward with the project proposed by the Commission, a full report of which was published in the NEWS, No's 8 and 9, and to the plan accompanying No. 9 we would refer to explain local allusions. He says that the evils brought to notice, and for which this scheme, in the popular mind, is the only and perfect cure, are these (stating them in the order of their gravity):

Odors at low water from flats at sewer mouths.
Height of ground water in the soil.
Flooding of cellars at South End in heavy rains.
Entrance of sewer gas into houses, and
Excessive death-rate.

The odors from exposed flats come almost entirely from the rear of Beacon street, and from the upper end of South Bay. The proposed new sewer would be a perfect cure for the latter; but Cambridge and Somerville would still drain into Charles River, the sewage would find its way to the former locality and the evil will not cease except by the exclusion of sewage entirely from the river. As only exposed mud-banks are offensive, rounding out the sea wall, extending the sewer outlets and dredging will remedy this evil.

The natural soil of the city proper, except a small area, is clay or hard-pan, almost impervious to water, and none is found in the ground at ordinary depths. On the Back Bay, a gravel filling, the water cannot be lowered below the level of the branch drains which are already there, as any back water from the larger sewers does not reach them. There is a district, the "South Cove," so-called, reaching from Dover to Essex street, in which, though filled with an impervious material, viz., dock mud there exists so many subterranean channels that the tide ebbs and flows throughout it. The benefits to health by the exclusion of this tide-water would be great, and the scheme proposed would, doubtless, effect this; in fact, it must do so or fail entirely in its object. But if the tide is shut out, and the cellars properly drained, as they should be for health, it will result in the destruction of every building in the district by depriving the piles, which are cut off at a high level, of the moisture which prevents their decaying. Of course, a contingency of this kind is a very serious matter for the city to contemplate before deciding to carry out the works.

The commission nowhere in their report assume that the new sewer will prevent the flooding of South End cellars. It can be assumed that the new works, if executed as proposed, will be for many years so much larger than their duties require, that a greater proportion of storm-water can be turned into them than from other parts of the city. But all the relief possible in this direction would not prevent flooding with the storms of the last month (March–April, 1876), and which are of annual occurrence. The relief by pumping, which is to be done at Neponset River, can, so far as it is necessary to cure this evil, be got with greater advantage and with less cost in the district itself.

After the completion of these expensive works, it is not expected that the air in the sewers will be so pure as to allow of its free entrance into houses, and the same measures to prevent its entrance will be as necessary then as now. It is owing to the neglect of local drains and house fixtures that most of the complaints have arisen. The number of drains leaking under houses and into foundations is very large, and is almost certain to occur with every house upon made land.

The expectation that the death-rate is to be lowered by building this sewer is disproved by a careful reading of the report of Dr. Curtis on the sanitary condition of Boston. The excessive death-rate is there shown to be among the Irish population and their young children. The districts where this class resides will hardly be reached by the proposed new sewer, and they are mostly upon such a high level that no change for the better is possible in the collection and discharge of their sewage. They now possess and avail themselves of, as far as the city can make them, the best drainage facilities; but the neglect of house connections above alluded too exists here in an aggravated form.

The construction of the sewer to Moon Island, at a cost of three to four millions of dollars, will be a very proper continuation of our drainage system when the population and wealth of the city demand it. But its influence on the prominent complaints of the day will be—

To remove the smell of flats from South Bay but not from Charles River.

To have no effect on soil water except in tide-flowed districts, and there to the peril of the buildings.

To alleviate (if anything short of total prevention is alleviation) the flooding of South End cellars; but to be helpless in heavy storms.

To demand the same precautions as are at present needed to keep sewer gas out of houses.

To have no appreciable effect upon the death rate.

There is a very small part of the whole population who, in their daily life, will be sensibly benefitted, or ever realize that this great sum has been expended for their health, and the whole who will pay may reasonably ask if the discomfort of the few may not be remedied, or at least palliated, by something less costly, and perhaps as effective, as the proposed works.

Sight Poles.

For the benefit of engineers and surveyors who use wooden "sight poles," I send you a description of a sight pole which I had made for my own use nearly two years since. It has been in frequent use in my practice during this time, and in my opinion is much superior to the wooden sight poles.

It is made of a piece of half inch iron gas pipe of about ¾ inch exterior diameter, An iron cap, or "plug," is screwed on the upper end and a steel point is welded into the other end. The one I use is 6 ft. 9 in. long including the steel point. The upper six feet are painted in alternate foot sections, vermillion and white.

Such a pole will retain perfectly its straightness. If accidently bent it can be easily straightened again. It can be easily thrust into ground that is quite hard or partially frozen, and when set up for observation, or for a "watch points," is less likely to be swayed or blown down by the wind than a wooden pole. It is smaller than a wooden pole and hence preferable for work requiring considerable accuracy.

Such a sight pole can be easily made in any city or village where the pipe can be procured, no extraordinary skill being required in its construction. Three dollars will cover its entire cost. For the best wooden poles instrument makers charge from six to ten dollars.

It is rather heavier than a wooden sight pole, but not enough so as to be objectionable on that account. Of course it must not be used, or allowed to stand, too near a compass when the magnetic bearings are being taken. In the ordinary use of the transit, especially for near points, the courses are seldom taken. A little care in this respect will obviate this objection.

E. A. AUGUR, City Engineer, Middletown, Ct.

The Civil Engineers' Club of the Northwest.

The regular monthly meeting of the Civil Engineers' Club of the Northwest was held on Tuesday evening, the 2d inst., at the Sherman House Club Rooms. President Chesbrough occupied the chair. After the approval of the minutes of the last meeting, the President reported the acceptance of Major G. L. Gillespie, U. S. A., by the Committee on Nominations as a candidate for membership of the club. An invitation was received from the American Society of Civil Engineers to meet with them at their annual meeting in June. The Secretary reported that he had sent $200 to Milnor W. Roberts of the Finance Committee of the American Society, as the contribution of the club towards defraying the expenses of Exhibition of Engineering at the Centennial. The matter of arrangements for the annual June meeting of the club was referred to the Executive Committee with power to act.

The subject for discussion—THE METRIC SYSTEM—was then introduced by S. S. Greeley who quoted some extracts form a paper by Coleman Sellers, Esq., of Philadelphia, read before a convention of Master Mechanics in this city, in 1874, wherein Mr. Sellers takes strong grounds against the introduction of the system as being accompanied with so great an expense in making the change from the present unit of measurement, the inch, to that of the metre as to put it out of the question entirely. The following letter from President F. A. Barnard, Columbia College, New York City, was read:

NEW YORK, April 11th, 1876.

SAMUEL S. GREELEY, Esq.,

Dear Sir,—I sincerely regret that it is not in my power immediately to assist you by furnishing any important documents of recent date in regard to the progress of the metric reform. The American Metrological Society has hitherto been financially too feeble to publish. I send you by this mail a copy of my brief report as chairman of the Committee on Weights and Measures of the American Association for the Advancement of Science, made to that organization at the Detroit meeting. The matter most immediately interesting the friends of the metric reform is to secure the ratification of the treaty to which the resolution at the close of this report refers. This treaty is now pending before the Committee on Foreign Affairs of the Senate of the United States. The American Metrological Society has not thought it fit to ask for the compulsory introduction of the metric system into this country as yet. The society have considered it most judicious to aim at securing the introduction of the metric weights and measures into departments of public service where they would be benificial to commerce, without interfering with the habits of thought of the citizens generally, believing that in this way the system would become familiarized to the people, and its advantages be made obvious, so that when compulsory legislation should be resorted to, at a later day, there would be no powerful opposition to encounter. The memorials which the society have had before the present and the last Congress are sent to you along with the report just mentioned. I am unable to furnish you with the reports on the proceedings of the international conference at Paris, at which the plan of the International Bureau of Weights and Measures was organized; or the diplomatic conference at which the proposition now pending before our Senate was negotiated. If anyone can furnish you with these things it will be Prof. J. E. Hilgard, of the Coast Survey, at Washington, who is a member of the Permanent Council of the International Bureau.

The paper of Mr. Coleman Sellers, to which you refer, is one very much to be regretted, as coming from a man like him. It does not follow that, because we change our system of weights and measures, we must immediately alter the dimensions of our machines, or implements of construction. These dimensions expressed in metric denominations will, of course, for the time being be a little less simple when separately taken; but they need not be summarily altered, and the new expressions, though involving individually, decimals, will still afford immense facilities for calculation when numbers are combined, such as our present measures do not furnish, I have seen no review of this paper; my personal opinion of it is given above.

Our society explicitly declined to unite with the Boston Society of Civil Engineers in the petition to make the metric system compulsory. We have no disposition to prejudice a good movement, which, properly followed up must secure in the end all that the most ardent advocate of the reform can desire, by asking action from a Congress too little friendly to the movement to be impressible even in regard to the slight measures of improvement which we advocate, to entertain for a moment any such proposition as that which the over zealous friends of the cause seem disposed to push.

I am, sir, very truly. your ob't. verv't.,

F. A. P. BARNARD.

The following is from Chas. Paine, Esq., Genl. Supt. L.S & M. S. R.R.:

CLEVELAND, O., April 13, 1876.

SAMUEL S. GREELEY, Esq.,

Dear Sir,—I have talked with our master mechanics and they confirm my idea, that the nearest denominator used now is one thirty-second of an inch, while the metric system gives the means of easily expressing one-tenth of that. But for *fits*, no mechanic ever uses a rule or any designated dimension. He takes the callipers and gets the size nearer than he can see to measure, by the touch. If I remember rightly, the article in Franklin Inst, Journal goes over all this ground. We could adopt the metric system in our shops tomorrow, by change of rules used by the mechanics, for measuring.

Yours truly,

CHARLES PAINE.

Communications were also received from W. B. Franklin, Vice President of the Colts Patent Fire Arms Mfg. Co. of Hartford, Ct.; from Willard S. Pope, C. E., President of the Detroit Bridge and Iron Works; a paper was read by R. J. McClure, C. E. of the C. B. & Q. K. R; and G. H. Frost illustrated, by diagrams of the section and its regular subdivisions, the method of adapting the new system to existing and future surveys of land. The further discussion of the subject was conducted by Messrs Greeley, Harris, Chesbrough and Soulerin. The written papers will be published next week, if possible.

The meeting adjourned.

Note on Finding the Strength of a Column of Irregular Shape.

BY THOMAS M. CLEEMANN, C. E.

Rankine's general formula for the strength of a column fixed at the ends is:

$$P = \frac{fS}{1 + a\frac{l^2}{r^2}}$$

in which S is the cross section of the column; l is the length of the column; r is the "last radius of gyration;" f for wrought iron, 36,000, and for cast iron, 80,000; a for wrought iron, $\frac{1}{36000}$ and for cast iron, $\frac{1}{6400}$

For columns of ordinary sections, the value of r can be found by the calculus, and its value for many such sections is given in Rankine's "Civil Engineering." It sometimes happens, however, that the cross section may be so irregular or discontinuous, that the calculus cannot be applied. It is then necessary to pursue a different method, and the following one, of obtaining the value of r by experiment, is believed to be new, and is recommended to engineers for its extreme simplicity. It is very similar to that used in Bartlett's "Mechanics," for finding the moment of inertia of a fly-wheel:

Draw the cross section on stiff cardboard, and cut it out carefully. Make a small hole in any part near the edge, through which insert a pin, and make it oscillate about the pin like a pendulum. Count the number of oscillations in a minute. The length of the equivalent simple pendulum is given by the equation:

$$L = \frac{140796}{N^2}$$

in which N is the number of oscillations performed in a minute. The radius of gyration is then found from the equation:

$$r^2 = \tfrac{1}{2}(Le - e^2),$$

in which e is the distance from the point of suspension to the center of gravity of the section, expressed in inches. The above is only true when the cross section can be divided symmetrically by two axes at right angles to each other. The sections of columns ordinarily used, however, such as those of the Phœnix Iron Co., and the Keystone and Kellogg Bridge Companies, conform to this condition.

In cases of great irregularity of cross section, the pin should be placed in two or three places near the outer edge, at equal distances from the center, and the experiment of counting the oscillations repeated. The greatest value of N is the one to be used.—*Journal of the Franklin Institute.*

A State Survey—Private and Public Need for It.

(From the New York Post.)

It is proposed to make an accurate survey of the state of New York. The advantages which will flow from such a work are clearly set forth by the American Geographical Society in a supplement to its first bulletin for the present year. The "serious evils, which can only be remedied by an accurate survey of the state," are of two kinds—public and private.

First, as to private evils. Trees, stones and other landmarks are disappearing, and there is a growing difficulty in finding boundaries of estates. The old surveys were so inaccurate that often courses and distances cannot be ascertained from them. The areas are wrongly given in many deeds. In Westchester county a lot described as containing seventy acres was found to contain eighty-seven acres. One in Flushing described as containing fifty acres was found to contain sixty-nine acres. The deeds of land upon which a railroad near this city runs gives areas making in all thirty-three miles, while the railroad is only thirty miles long. In the words of the supplement, "it is not too much to say that hardly in one case in a thousand do deeds in the state of New York describe correctly the area of real estate conveyed." It is not surprising that a consequence of all this is cestly litigation.

Secondly, as to public evils. A just valuation of land for the purposes of taxation can be made, of course, only with an accurate knowledge of its area. If areas are wrongly given in deeds, if they cannot be exactly ascertained from existing surveys, it is impossible for the assessor to assess fairly. It was discovered recently that ten citizens whose property ought to have been valued at $250,000 were taxed upon $579,000, and ten whose assessment ought to have been $700,000 were taxed upon $450,000. In Flushing it was found that about one-tenth of the land was escaping taxation. In Yonkers five hundred and twenty-five acres have escaped. If one lot and one owner are taxed too little or not at all, it is plain that another lot and owner must be taxed too much.

There seems to be only one remedy for either of these classes of evils—an accurate survey of all the lands in the state. The supplement shows what has been done in Europe:

"Very exact triangulations or trigonometric surveys like that of our own United States Coast Survey, have been made, and, at short intervals, a system of imperishable monuments established whose distance and direction from one another is known; and the corners of all estates towns or counties are connected with these practically indestructable landmarks. The positions of these points, with reference to one another, and the distances and directions from them to property corners, are measured with *absolute* precision by triangulation. Having then permanently fixed landmarks and exact measurements, it is easy to describe each owner's land with such perfect accuracy that no boundary can possibly be lost."

The cost of the work would be trifling compared with its benefits. It is estimated by the supplement that $20,000 would be enough for the first year, and from $30,000 to $50,000 for following years. To keep within this estimate it is necessary that the work shall be entrusted to trustworthy persons. Dr. Hayes' bill, which he introduced in the Assembly a short time ago, names William A. Wheeler, the well-known member of Congress, Horatio Seymour, Lieutenant-Governor William Dorsheimer, Fred Lau Olmsted and Francis A. Stout as a commission to conduct the survey. It would be difficult to select a better set of men for the work proposed. The only objection which can be made to the project is the passing one of the present hard times, and whether that is a sufficient reason for delaying the work is very doubtful.

One of the most important points brought out in the Assembly debate on a state survey was the economy of the work in saving large sums now annually wasted by litigation. This view is very well understood in Europe where science is applied to public affairs with far more foresight than seems possible in a republic. Great Britian, France, Sweden, Germany, Austria, Russia, Switzerland and Italy have all made accurate surveys of their territories; and, as a consequence, this endless series of disputes about boundaries, which waste so much time and temper here, is there a thing unknown. While our enlightened country has been content to quarrel for seventy-five years over uncertain boundaries, rudely measured with chain and compass, from such perishable landmarks as stumps and stakes, these "effete despotisms" went quietly to work and applied the only known method of preventing confusion—a careful trignometric and topographical survey. Poor surveying has been a most prolific sourse of trouble to our landowners. All engineers know this, and know perfectly well that there can never be any possible cure for our difficulties about measurements and positions of lines, without an accurate triangulation of the state's surface, upon which to found local, detailed surveys. Every dollar spent in such a work will save ten from being wasted hereafter.

Correction.

In the article entitled "Micrometer or Stadia," published in our last issue, we make the following corrections: In the centre column, near the middle, "substitute 0.5" should read *subtract* 0.5. Next line, $n - \frac{1}{100}$ should read $n = \frac{1}{100}$. In the last column, 51st line, the first term of the equation should be $\frac{1}{.500005}$.

SPECIAL NOTICE.

Copies of volume One of this journal are constantly in demand, and any parties who have the complete volume and wish to sell or exchange for volumes 2 or 3, will please to communicate the fact to the publisher. Numbers 2 and 7, volume 3 are still wanted and *one month's subscription* will be given for either.

Wm. Kirton was appointed Superintendent of the St Louis Water Works, and Americus Warden, Engineer in charge of the pumping department, by the Common Council of that city, last week.

A New Deodorizer.

Dr. Goldin, in the London *Lancet*, directs attention to the great value of chloride of lead as a deodorizer. He prepares it by dissolving half a drachm of nitrate of lead in a pint or more of boiling water, and pouring the solution into a bucket of water in which two drachms of chloride of sodium (common salt) have been dissolved. When the sediment has subsided, the clear supernatant fluid is a saturated solution of chloride of lead. Dr. Goldin says that a cloth dipped in this solution and hung up in a room will instantly sweeten a fetid atmosphere; or if the solution be thrown down a sink, water closet, drain, or over a heap of dung or refuse, a like result will ensue. In this way he disinfected a house in which a drain had burst, some stables and also a large ship. In the last case the bilge water was exceedingly offensive. He merely dissolved half an ounce of nitrate of lead in a bucket of boiling fresh water and had it thrown down the bilge when the ship was rolling slightly. The effect was the instant disappearance of all smell.

Contractors' Intelligence.

The contract for building the Cass County jail, at Virginia, Ill., has been let to James F. Black, for the sum of 14,000.

The Board of Public Works last week awarded the construction of the standpipe for the Chicago (West Side) pumping works to P. Soulerin, for $3,600;

The Secretary of War has awarded the contract for the cut stone for the new locks at St. Mary's Falls canal improvement to Mr. F. D. Van Wagenen, of Fulton, N. Y.

The Wisconsin Board of State Charities has adopted plans for the Blind Asylum, as drawn by Architect A. Anderson, of Janesville, and work will be commenced at once.

The Penn Bridge Works of New Brighton, Pa., are building a new iron bridge for the city of Jamestown, N. Y. It is to be a one hundred foot span, and eighteen foot roadway, with two sidewalks, the cost being about $28 per foot.

The Board of Supervisors of Peoria County, Illinois, last Tuesday, awarded the contract for the construction of the new Court House at Peoria, Ills., to P. H. Decker of Chicago, at the price of $206,71.30. The building which is to be of Amherst stone will be commenced as soon as the necessary arrangements for issuing bonds, etc., can be made.

Two additions to the Soldiers' Home at Milwaukee, Wis., have been decided on, and the contracts awarded to Mr. Henry, for mason-work, and Mr. Manoch Morris, for carpenter-work. The latter will be remembered as one of the original builders of this great institution, and is well known in Chicago as the Superintendent of Construction of the Chicago, Rock Island & Pacific new depot, put up in 1872-3. The work will soon be commenced.

The following bids for the metallic cornice and roofing of the dome of the new State House at Springfield, Ill., were opened by the State House Commissioners last Thursday: Frederick Hartman, $58,000; Slavic & Warner, $52,000 ; J. W. Atkinson, $47,644; McFarland & Price $45,610; A. Knisley & Co. $41,412; Line Roofing & Ornamental Co., $40,970; Dunn & Witt, $40,488; Klugel & Hinckley, $37,500. The contract was awarded to Klugel & Hinckley for $37,500.

PROPOSALS FOR CONTRACTS.

BRIDGE.—Proposals for building a wooden bridge across the Cedar River, in the town of Udolpho, will be received at the County Auditor's office in Austin, Minn., until the evening of May 13th. Specifications may be seen at the County Auditor. By order of the Bridge Committee. Willim Richards, Chairman.

BRIDGE.—Proposals will be received at the office of the City Clerk of the city of Clinton, De Witt Co., Ills., up to 12 o'clock noon, on Wednesday, May 10, 1876, for the construction of a Howe Truss Iron Bridge across Ten-mile creek in that city. The bridge will have a span of forty feet, and twenty-four feet wide, including a five feet sidewalk and a double wagon road. Also, for the necessary stone work for the abutments of the bridge. Bids for the stone work will be at so much per yard. Plans and specifications can be seen at the Clerk's office. Wm. Bishop, Mayor, M. Donahue, City Clerk.

COUNTY BUILDING.—Proposals will be received until 12 o'clock, noon, on Thursday, May 11, 1876, at the County Farm House, situated on the southeast quarter section 13, township 48, range 32, for the erection of an additional building of the size and dimensions of the building already occupied as an asylum on said farm. Payment of same to be made in cash. W. Z. Hickman, County Clerk, Kansas City, Mo.

COURT HOUSE AND JAIL.—Proposals will be received by the County Commissioners of Sweetwater County, Wyoming Territory, at the County Clerk's office, Green River City, up to 1 o'clock, P. M., May 15th, 1876, for the furnishing of material and building of a Court House and Jail at Green River City, according to the plans and specifications which can be seen at the County Clerk's office at Green River City, Wyoming Territory. Bonds will be required in double the amount for the faithful performance of the contract. W. P. Noble, Chairman County Commissioners. A. McIntosh, County Clerk.

COUNTY POOR HOUSE.—Bids will be received at the office of the County Auditor, in Dubuque, Ia., until 2 o'clock Wednesday, May 10th for furnishing all material required and for the erection and completion of the new poor house building, on the S. E. S. W. of section 30, in Julien township, according to plans and specifications now on file in said office. Each bid must be accompanied by a written guarantee signed by at least two responsible parties, to the effect that in case the bidder is awarded the contract, he will at once enter into satisfactory bonds for its faithful performance. At the time mentioned the contract will be awarded to the lowest and best bidder. Wm. Coates, Chairman Board Supervisors, Dubuque county.

DREDGING.—The Board of Improvements will receive bids at Cleveland, O., until 12 o'clock M., May 15, for the necessary dredging and other labor in removing bars and obstruction, in the Cuyahoga River, between the Government Pier and Upper Central Way Bridge. Plans and specifications may be seen and blank proposals can be obtained at the office of the City Civil Engineer after May 1st. Each proposal must contain the full name of each person in and making the bid. No proposal will be entertained unless made on the blanks furnished be the engineer and no proposal will be accepted unless the party or parties making the same shall furnish evidence satisfactory to the Board, that they have the necessary machinery, experience, energy and ability for doing the work, is trustworthy, has sufficient pecuniary resources and is prepared to commence the work within five days after the contract is approved by the council. A bond of $2,000, with surety to be approved by the Board must accompany each proposal that in case the proposal is accepted a contract will be entered into within eight days after the award is made. The right is reserved on the part of the Board, to reject any or all proposals not in accordance with the conditions of this advertisement or that do not conform with the specifications furnished by the engineer. B. F. Morse, City Civil Engineer.

GAS FIXTURES AND HARDWARE.—Proposals will be received by the Commissioners of Construction of the Central Ohio Hospital for Insane, until 12 o'clock noon, Thursday, May 11, 1876, for the Gas Fixtures for the entire building, and Locks, Bolts and Latches, for eight wings of Asylum building. Plans, specifications and blanks are now on file at the office of the Architect upon the Asylum grounds, for the inspection of bidders. All bids must be sealed and directed to Geo. W. Manypenny, Esq., President of the Board of Commissioners, Columbus, Ohio, and indorsed Proposals for Gas Fixtures, or Proposals for Locks, etc., as the case may be, and left at the office of the Architect. By order of the Board. T. R. Tinsley, Architect, Columbus, Ohio.

IRON LIGHTHOUSE.—Proposals in duplicate will be received at the office of the Lighthouse Engineer, Fourth District, No. 532 Walnut St., Philadelphia, until 12 o'clock M., Monday, May 15th, 1876, from Iron Manufacturers only, for furnishing all the metal work of superstructure, and for the erection of the same, of two Lighthouses, to be known as Liston's Tree Range Lights, Delaware bay. The right to reject any or all proposals, or to waive defects, if it is deemed for the interest of the United States to do so, is reserved. Drawings and specifications furnished on application at this office. By order of the Lighthouse Board. W. F. Raynolds. Brevet Brigadier General, Engineer Fourth Lighthouse District.

IMPROVEMENTS.—Bids will be received at the City Clerk's office, Columbus, O, until Monday, May 15, at 12 o'clock M, for furnishing materials and doing the following work, to-wit: For building an eighteen inch pipe sewer in Myrtle alley from Broad street to Almond alley. For grading and graveling Fifth avenue; from Summit street to the east corporation line. For grading and bouldering Spring street, from High street to Front street; with Ohio river or bank boulders. For contructing a brick sewer in Town street. from Fair alley to the Scioto river, of the following dimensions: Two feet from Fair alley to Front street, and two and a half feet from Front street to the river. Josiah Kinnear, City Civil Engineer.

LIFE SAVING STATION HOUSES.—Proposals will be received at the Treasury Department in Washington, D. C., until 12 o'clock M, of Tuesday the 25th of May, for the construction of Life Saving Station Houses at the following named points on the coast of Lake Superior, to-wit: One at Vermillion Point, one at a place seven miles west of Vermillion Point, one at Two Heart River, and one at Sucker River, all in the state of Michigan. Bids will be received for one, several, or all of the above mentioned houses, and bidders must state the number they will build and designate the localities. Each bid must be accompanied by a bond in the sum of one thousand dollars, with two good and sufficient sureties, conditional that the bidders shall enter into contract without delay if his bid be accepted, All proposals must be indorsed, "Proposals for the construction of life-saving station houses, coast of Lake Superior," and addressed to the Secretary of the Treasury, Washington, D. C. Specifications and plans, and forms of proposal and bond can be obtained at the office of the Collectors of Customs at Detroit, Port Huron, Grand Haven and Marquette, Mich., Chicago, Ill. and Milwaukee, Wis. also upon application to this Department. B. H. Bristow, Secretary.

MASONRY AND BRICKWORK.—Proposals will be received by the undersigned, for foundation walls of stone and brickwork thereon, for the machine shops of the B. C. R. & M. R. R., at Cedar Rapids, Iowa. Plans and specifications can be seen at the office of the Engineer of the road, in Cedar Rapids where any information required will be furnished. E. F. Winslow, Receiver.

OLD IRON RAILS.—Tenders are invited for the purchase of Old Iron Rails, delivered as follows: About 7,000 tons at Toronto, Sarnia, Detroit Junction, or Buffalo. About 1,000 tons at Montreal, or Point Levi,(opposite Quebec). About 3,000 tons at Portland. The company has wharfage accommodation for shipment by water at Toronto, Sarnia, and Portland, and deliveries would be made commencing with May, and extending through the summer. Offers stating the price per ton (of 2,240 lbs.), and the place of delivery, will be received by the undersigned at Montreal, Canada, up to the 15th of May. Joseph Hickson, General Manager, Grand Trunk Railway.

PUBLIC PARKS.—The Standing Committee of the City Council of Toronto, Ontario, on Walks and Gardens, offer $1,050 in Six Prizes for the best plans and scheme for laying out and embellishing the Public Parks of the city, as follows:—

For the Queen's Park, 1st prize	$300
For the Queen's Park, 2d prize	50
For High Park, 1st prize	300
For High Park, 2d prize	50
For the Eastern Park, 1st prize	300
For the Eastern Park, 2d prize	50

Persons competing must submit an estimate of the approximate cost of carrying out the work, which is to be extended over a term of years, and a statement of the manner in which it is proposed to carry out the same. The plans adopted to become the property of the Committee, but the Committee do not bind themselves to accept any plan if they do not consider it of sufficient merit. The plans, etc., must bear a motto without any other mark by which the designer may be known, and be accompanied by a communication, containing the same motto, with the name of the designer, which will not be opened until the prizes have been awarded. They must be left at the office of the City Clerk, City Hall, not later than noon, on Wednesday, the 17th of May next. Plans of the Parks can be seen, and all other information obtained at the office of the City Clerk. P. G. Close, Chairman Walks and Gardens Committee.

RAILROAD WORK.—Proposals will be received at our office in Dayton, O., for grading twenty miles of the D. & S. E. R. R. Profiles ready. Phelps, King & Co.

REFORM SCHOOL.—The Board of the Ill. Reform School will receive proposals at Pontiac, Ill. up to 4 o'clock, P. M. of Thursday, May 14, 1876, for the erection of one family building, to accommodate fifty boys, in accordance with the plans and specifications to be seen at the bank of Joseph F. Culver & Co., Pontiac, Ills. Bids must be accompanied by a bond of $500 binding the successful bidder to enter into a contract, with a bond of $16,000, for the proper completion of the building according to the plans and specifications. O. Huse, Solon Kendall, Jos. F. Culver, Trustees.

RAILROAD WORK.—Proposals for contracts will be received by the undersigned, at Waverly, Pike Co., Ohio. until the 10th day of May, for the graduation and masonry on the Springfield, Jackson & Pomeroy Railroad, from Springfield, in Clark county to Washington, in Fayette county, Ohio, and from Waverly, in Pike county, to Jackson C. H. in Jackson county, O. Bids will be received from these portions of the line as a whole or by sections, the company reserving the right to reject any or all bids; also to relet the work prior to that date should satisfactory bids be received. Profiles and specifications can be seen and general information given at the chief engineer's office at Waverly, Ohio. James Emmett, President. W. C. Agnew, Chief Engineer.

RAILROAD WORK.—Sealed tenders, addressed to the Secretary of Public Works and endorsed "Tender Pacific Railroad" will be received at the office of the Department of Public Works in Ottawa, Ontario, until 12 M., Monday, May 22d for the excavation and grading required to be executed on that section of the Canadian Pacific Railway extending from Cross Lake, eastward to Rat Portage, Lake of the Woods, about 37 miles in length; also for the grading required from the westerly end of the 13th contract to English River, a distance of about 80 miles; also for tracklaying and other work of construction west of Fort William. For plans, specifications, approximate quantities, forms of tender and other information apply to the office of the Engineer-in-Chief, Ottawa. No tender will be entertained unless on the printed form, and unless the conditions are complied with. By order, F. Braun, Secretary.

STREET IMPROVEMENT.—Proposals will be received at the office of the City Clerk, Columbus, Ohio, until Tuesday, May 16, 1876, at 12 o'clock noon, for grading the Roadway of North High street, from Naghten street to First avenue, in accordance with plans and specifications on file in the City Engineer's office. By order of the Commissioners for the improvement of North High street. H. M. Neil, Secretary.

SCHOOL HOUSE.—Proposals will be received by the Board of Directors of the Independent School District of Vinton, Benton Co., Iowa, at the Auditor's office, until 5 o'clock P. M. of May 13, 1876, for the building of a School House in said Independent school district. Said school house to be built in accordance with the plans and specifications on file in the County Auditor's office, Vinton. By order of Board of Directors, A. S. Chadbourne, President, E. M. Evans, Sec.

SCHOOL HOUSE.—Bids for the erection of a brick school house in Sub-district No. 4, in the district township of Glenwood in the county of Mills and state of Iowa, will be received by the undersigned at the law office of Watkins & Williams, in Glenwood, where plans and specifications may be seen until 1 P. M., May 13th, at which time the contract will be awarded to the lowest responsible bidder. S. G. Gohen, Sec'y. of the Board of Directors.

STATE REFORM SCHOOL.—The trustees of the Iowa Reform School hereby give notice that they intend to erect a main building for said school, and will receive bids for three hundred thousand or more brick of best quality, delivered in Eldora. Two hundred or more legal perch of best quality foundation stone, delivered at Eldora or at quarry, also the price per m. of the various kinds of lumber necessary for such building, all to be delivered as above. All bids will be addressed to E. Andrew, Eldora, Iowa, and will be received until May 31st, at which time they will be opened and examined. J. A. Parvin, president. T. E. Corkhill, secretary.

STREET IMPROVEMENTS.—Proposals will be received by the common council of Ft. Wayne, Ind., at the office of the city civil engineer, until Tuesday the 9th day of May, for grading and planking the sidewalks on the north side of Wayne St. from Harmer St. to Hanover St. For grading and planking the sidewalks on the west side of Clay St. from Virginia to Lasselle St. For grading and planking the sidewalks on both sides of Douglass St. from Wells St. to the west line of Clark's addition, and for the construction of a twelve inch cement or vitrified clay pipe sewer in the alley between Berry and Wayne Sts. and running from the east line of Ewing St. to the Harrison St. sewer. Plans and specifications can be seen at the office of the city civil engineer where all information concerning said work can be obtained. By order of the common council. John Ryall, City Civil Engineer.

STATE PENITENTIARY.—The undersigned commissioners under an act of the State of Texas, approved February 16 hereby advertise for proposals of plans, specifications and other particulars for the proper and substantial building and completion of two penitentaries in said state in conformity to the modern forms of constructing public prisons, which have proven to be the best for the health and comfort of the convicts. One of said penitentaries to be built about two miles north of Rusk, in Cherokee county, with a view of utilizing in manufactures the iron ores which abound in this section of the state; the other to be bnilt at the head of the San Marcos River, in Hayee county, contemplation of the manufacture of cotton, wool, leather and other goods and fabrics, that will not come into competition with the personal industries of the mechanical professions. Said penitentaries are to be completed by the first day of July 1877, and parties making proposals of plans, etc., for both, or either of said penitentaries, will state upon what terms and for what amounts they will build the same, and will, in connection with said proposals, furnish due guarantees of their abilities to build and complete the same in accordance with such plans, etc., and by the time limited. Persons desiring to inspect the sites indicated will call on E. L. Gregg, at Rusk, or Gen. Ed. Burleson at San Marcos, and all proposals will be addressed to E. L. Gregg, at Rusk, Cherokee county, Texas. The commissioners expressly reserve the right to reject any and all proposals, and hereby give notice that no compensation will be made for any proposals, plans, etc., which may be submitted under this advertisement. W. W. Lang, Ed. Burleson, B. W. Brown, E. L. Gregg, Commissioners.

SCHOOL HOUSE.—Bids for building a brick school house in Independent School Dist. of Hastings, Mills Co. Ia., will be received by the undersigned at his residence in the said district, where plans and specifications may be seen until 2 o'clock in the afternoon of May 13th, 1876. A. P. Provost, Secretary Board of Directors, Hastings, Iowa.

SCHOOL HOUSE.—Proposals will be received by the Board of Directors of the Independent School District of the city of Burlington, Iowa, for the erection of a two-story addition to the "West Madison" School House, until 9 o'clock, A. M. of May 20th, 1876, according to plans and specifications which will be ready for inspection at the office of the Secretary, in Parson's block, on and after April 25th. Separate bids will also be received for window blinds for the whole building. All bids must be signed by the party proposing to do the work, securely sealed, and endorsed, "Proposals for erecting West Madison addition," or "Proposals for blinds." and delivered to the Secretary before the hour above fixed. By order of the Board. Geo. Frazee, Secretary.

TURNPIKE.—Grading and graveling of the Vossler Pike, running from New Bremen, Anglaize County, west to the Mercer County line, will be let by public outcry at the door of the Town Hall, New Bremen, Ohio, on Tuesday, May 16, 1876, to the lowest and best bidder or bidders. Plans and specifications can be seen at the Auditor's office in said county. The contractor will be required to enter into bonds immediately after the letting for the faithful performance of the work. Sale to commence at 1 o'clock P. M. Samuel Craig, Engineer,

TURNPIKE,—The grading and graveling of the Schmieder Pike about seven and a half miles long, in Jackson Township, Auglaize County, Ohio, will be let by public outcry at the door of the Town Hall, Minster, Ohio, on Monday, May 15, 1876, to the lowest and best bidder or bidders. Plans and specifications can be seen at the Auditor's office in said county. The contractor will be required to enter into bonds immediately after the letting for the faithful performance of the work. Sale to commence at 1 o'clock P. M. Samuel Craig, Engineer.

WATER WORKS.—City Council of Peoria, Ill. invite bids, accompanied with plans and specifications, for building a filter bed at the water works. Bidders will state the plan of filtration proposed, the size and shape of bed, and nature of materials they propose to use. Bids to be left with the city clerk on or before May 24, 1876. Chas. H. Kellogg, Thos. J. Kelly, John P. Cress, Water Works Committee.

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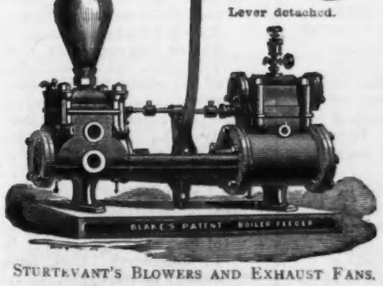

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